sound in "Rice"" contains most of its energy above 3.2 kHz; this filtering effect is why it is extremely difficult to distinguish the sounds "s" and "f" over the telephone. Try this yourself: Call a friend and determine if they can distinguish between the words "six" and "fx". If you say these words in isolation so that no context provides a hint about which word you are saying, your friend will not be able to tell them apart. Radio does support this bandwidth (see more about Signal-to-Noise Ratio of an Amplitude-Modulated Signal (Page 278)).

Efficient speech transmission systems exploit the speech signal's special structure: What makes speech speech? You can conjure many signals that span the same frequencies as speech car engine sounds, violin music, dog barks but don't sound at all like speech. We shall learn later that transmission of any 5 kHz bandwidth signal requires about 80 kbps (thousands of bits per second) to transmit digitally. **Speech** signals can be transmitted using less than 1 kbps because of its special structure. To reduce the "digital bandwidth" so drastically means that engineers spent many years to develop signal processing and coding methods that could capture the special characteristics of speech without destroying how it sounds. If you used a speech transmission system to send a violin sound, it would arrive horribly distorted; speech transmitted the same way would sound fine.

Exploiting the special structure of speech requires going beyond the capabilities of analog signal processing systems. Many speech transmission systems work by finding the speaker's pitch and the formant frequencies. Fundamentally, we need to do more than filtering to determine the speech signal's structure; we need to manipulate signals in more ways than are possible with analog systems. Such flexibility is achievable (but not without some loss) with programmable digital systems.